

Controlling Eutrophication along the Freshwater–Marine Continuum: Dual Nutrient (N and P) Reductions are Essential

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Abstract

Expanding human activities along the freshwater to marine continuum of coastal watersheds increasingly impact nutrient inputs, nutrient limitation of primary production, and efforts to reduce nutrient over-enrichment and eutrophication. Historically, phosphorus (P) has been the priority nutrient controlling upstream freshwater productivity, whereas nitrogen (N) limitation has characterized coastal waters. However, changing anthropogenic activities have caused imbalances in N and P loading, making it difficult to control eutrophication by reducing only one nutrient. Furthermore, upstream nutrient reduction controls can impact downstream nutrient limitation characteristics. Recently, it was suggested that only reducing P will effectively control eutrophication in both freshwater and coastal ecosystems. However, controls on production and nutrient cycling in estuarine and coastal systems are physically and chemically distinct from those in freshwater counterparts, and upstream nutrient management actions (exclusive P controls) have exacerbated N-limited downstream eutrophication. Controls on both nutrients are needed for long-term management of eutrophication along the continuum.

Keywords Nutrient limitation. Nitrogen. Phosphorus, Eutrophication, Freshwater to marine continuum, Water quality